

Failure Modes and Effects Analysis/Critical Items List

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 Title: Risk Assessment Executive Summary Report (RAESR) for the USA SAFER

Item Name: Power/Test Switch Qty: 1 FMEA Number: US-SFR-375
 Item Part Number: 231AT202 ORU Name: SAFER
 Subsystem Name: HCM ORU Part Number: SED33105900-311
 Function: Controls power and test selection.

Item Type Designator: C PG/IP Identifier: N/A
 Reference Designator/Find No.: N/A Drawing Number: SED33106100
 Logistics Control Number: N/A

End Item Name: SAFER
 End Item Capability: Six degrees of freedom through 24 thrusters, each rated at 0.8 ± 0.08 lbs. force in vacuum.
 End Item Function: Provides emergency EVA self-rescue for separated crewmember.
 ISS Zone: EVA Shuttle Zone: EVA

	Criticality		ISS	Shuttle
Critical Item: Yes: _____ No: <u> X </u>	Criticality Category:		1R	1R/3
Success Paths: 1, close the Manual Isolation Valve to prevent unwanted movement and loss of GN ₂	Success Paths Remaining:		0	

Failure (Mode, Cause, Detection, Corrective Action)

Failure Mode: Power/Test Switch inadvertently initiates power to PSA.
Failure Mode Code:
Failure Cause: Switch Failure, EEE part failure, short/open circuit, contamination, software error, radiation event, EMI.
Failure Detection:
 Flight: IVA – IVA checkout.
 EVA – EVA crewmember may hear clicking of SAFER thruster during rotation movements.
 Ground: Functional Test.
Time To Detect Quantity: 60 **Time To Detect Units:** Seconds
Correcting Action: IVA – If failure is detected during IVA checkout, use back-up SAFER if available.
 EVA – If detected during EVA, move Manual Isolation Valve into the “off” position. If Manual Isolation valve is not closed, these corrections would be easily overcome by the crewmember while holding on to structure.
Remarks: If the power switch fails “ON” during an EVA, the pyro will fire and the propulsion system would be pressurized. Additionally, the Automatic Attitude Hold (AAH) would become active. Only 1.6 lbf times a max. 21 inch moment arm would be acting against a combined EMU/SAFER/tools mass of approximately 650 lbm. SAFER is designed to provide a linear acceleration of 0.2 +/- 0.04 ft/sec² and an angular acceleration of 10.0 deg/sec². Additionally, if SAFER power is left “on”, the battery will be depleted in approximately 4 hours.
Failure Effect Phase: EVA Operations **Affected Stage(S):** EVA Operations

Failure Effect

On ORU/Assembly:
 First (this) Failure: SAFER would become active, with the AAH attempting to correct EVA crewmember rotations. All GN₂ could be expended in approximately one and one half minutes.
 Second/Third Failure: Inadvertent EVA crewmember separation, with no means of self-rescue from SAFER.
On Subsystem/Next Assembly: None.
On End Item/Segment: Possible loss of mission objectives if detected during IVA checkout.
On Crew/ISS: If EVA crewmember failed to detect thruster firings, the SAFER would expend all GN₂ attempting to perform AAH function. The battery power would also be depleted in approximately 4 hours. This could result in loss of self-rescue capability.
Time To Effect Quantity: 1 **Time To Effect Units:** Minutes

Redundancy Screen

ISS (Shuttle)			
Checkout Pre-Launch (A):	Pass		
Checkout On-Orbit (B):	N/A		
Detection Flight Crew:	Pass	Or	Detection Ground Crew: Fail
Loss Of Redundancy From A Single Cause (C):	Pass		